

Advantech ADAM Modbus Device Driver Guide

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1. Introduction

1.1 Overview

1.1.1 Modbus Protocol

Modbus is a "De-facto" standard for communications especially for connection of SCADA and HMI systems to intelligent operator panels, PLCs and controllers.

Modbus is an "open" communications protocol designed for industrial control and monitoring applications.

Many Automation Control Devices support the Modbus protocol in both Serial Modbus RTU/ASCII and Modbus Ethernet.

Via these protocols, PLC, Single Loop and Multi-Loop Controllers, RTU, DCS, computers, shop floor operator panels and other devices can communicate throughout plants and substations.

Advantech WebAccess SCADA Node provides a Modbus master interface using Modbus RTU or Modbus Ethernet protocol for communicating with Modbus slave devices. With ADAMModbus Device Driver, many Advantech ADAM modules can connect with Advantech WebAccess conveniently.

Modbus ASCII

In Modbus ASCII, each byte(8-bit) in a message is sent as two ASCII characters. The main advantage is that it allows up to one second time interval between characters without causing an error.

Modbus RTU

This is the default protocol of the Advantech WebAccess ADAM Modbus serial device driver. In Modbus RTU, each byte(8-bit) in a message, contains two 4-bit hexadecimal characters. The main advantage of Modbus RTU is its greater character density allows better data throughput than Modbus ASCII at the same baud rate.

Advantech WebAccess can scan every 100 milliseconds over serial connections limited only by the PLC, Controller or RTU and the connection.

Most modern Modbus serial devices use Modbus RTU, including Advantech ADAM modules.

Modbus Ethernet

Modbus Ethernet network is a single master, multi-drop network, which supports up to 247 slave devices.

The preferred physical layer for the Modbus Ethernet network is TCP/IP over Ethernet, although any TCP/IP network connection is supported including the Internet, WANs and LANs.

A single IP address can support up to 255 devices. Serial communications can be "encapsulated" into TCP/IP packets using Modbus Serial-to-Ethernet gateways.

1.1.2 ADAM Modbus Device Driver

You can use ADAM Modbus Device Driver when connect ADAM modules and Advantech WebAccess software by serial or Ethernet. But not all ADAM modules support Modbus Protocol especially the early ones. You can get the support list from Advantech Application Engineer or log onto Advantech website for more information. Part of the support list is available in the following chapter.

1.2 Support List

Table 1.1 ADAM modules support Modbus Protocol

Modules	Support	Requirement
ADAM5000/485 ADAM5000E	Modbus RTU	Need firmware Version as: A3.08 or above
ADAM5000/TCP	Modbus TCP	
ADAM5510M ADAM5510E	Modbus RTU	
ADAM5510/TCP ADAM5510E/TCP	Modbus TCP	
ADAM5510KW/EKW	Modbus RTU	Firmware Version 1.21 or above will work well
ADAM5510EKW/TP	Modbus RTU and Modbus TCP	
ADAM5511	Modbus RTU	
ADAM6050/W ADAM6060/W ADAM6051 ADAM6052 ADAM6060 ADAM6066 ADAM6015 ADAM6017 ADAM6018 ADAM6024 ADAM6022	Modbus TCP	
ADAM4015/T ADAM4017+ ADAM4018+ ADAM4019+ ADAM4024 ADAM4051 ADAM4055 ADAM4068 ADAM4069	Modbus RTU	You should get the information from manual or get help from technical support engineer

Note: Modbus ASCII is not supported by most ADAM modules at present, Modbus RTU is the default for serial device.

1.3 Requirements

1.3.1 ADAM Utility

Some ADAM utilities can be used to configure ADAM modules in Advantech WebAccess software. Log onto Advantech website at <http://www.advantech.com.cn/Support/index-1.asp> to get these utilities.

Table 1.2 ADAM utility used in configuration

Module	Utility	Requirement
ADAM5000/5000E	ADAM-4000-5000 Utility	Version 4.00.06 or above
ADAM5000/TCP	ADAM-5000TCP/6000 Utility	Version 2.36.30 or above
ADAM5510KW/EKW	ADAM-4000-5000 Utility	Version 4.00.06 or above
ADAM5510EKW/TP	ADAM-5510 Series Utility	Version 1.31 or above
ADAM6000Serial	ADAM-5000TCP/6000 Utility	Version 2.36.30 or above
	uScope Remote Display	

1.3.2 Wiring and Cabling

The Modbus protocol allows standard RS-232 and RS-485 communication formats.

The cable type is device and application-specific. Refer to the hardware manuals for proper cabling requirement.

Under most circumstances, you can use RS-232 straight-through cable to connect ADAM modules and computer. But when configure ADAM5510KW series modules with ADAM-4000-5000 utility, please use RS232 cross-over cable. When connect PC and ADAM modules with RS-485, please use RS-232 straight-through cable to connect PC and ADAM-4520(RS232 to RS422/RS-485 converter).

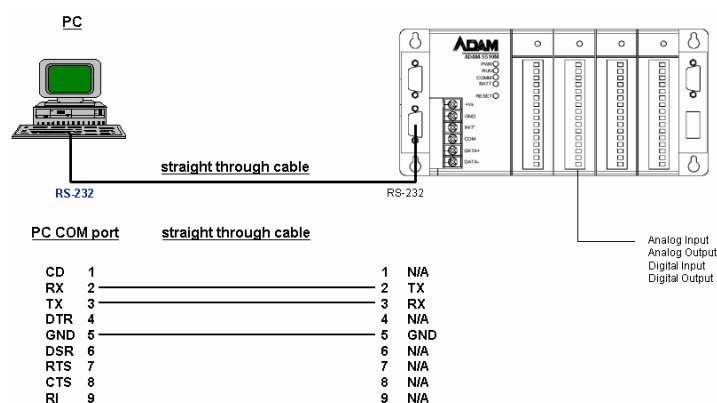


Fig. 1.1 RS-232 straight-through cable

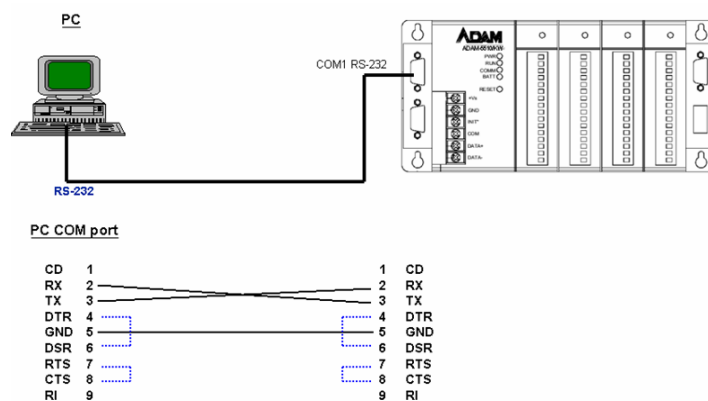


Fig. 1.2 RS-232 cross-over cable

It is necessary to prepare a cross-over Ethernet cable to configure ADAM modules during Modbus Ethernet protocol configuration. Do it as follows:

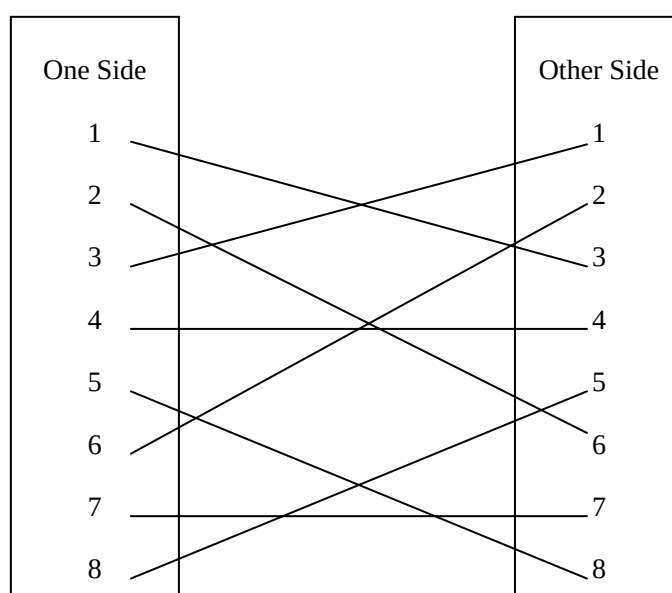


Fig. 1.3 Cross-over Ethernet cable

1.3.3 Reference Manual

The following manuals provide information on configuration of ADAM modules and Advantech WebAccess via Modbus Protocol:

- ADAM 5000-485 7.1th.pdf
- ADAM 5000TCP 3rd.pdf
- ADAM-5510KW Series Manual Ed-1.1.pdf
- ADAM-6000 series Manual pdf file (Depend on which module you need)

Log onto our website at <http://www.advantech.com.cn/Support/index-1.asp> for download

2. Hardware Configuration

2.1 ADAM-5000/485 Series

When you apply ADAM-5000/485 series modules including ADAM-5000E series (ADAM-5000M series is not included at present) in Advantech WebAccess, do as follows.
If the version of your ADAM-4000-5000 Utility is 4.00.06 or above, please use RS232 straight-through cable to connect between PC and ADAM modules as follows,

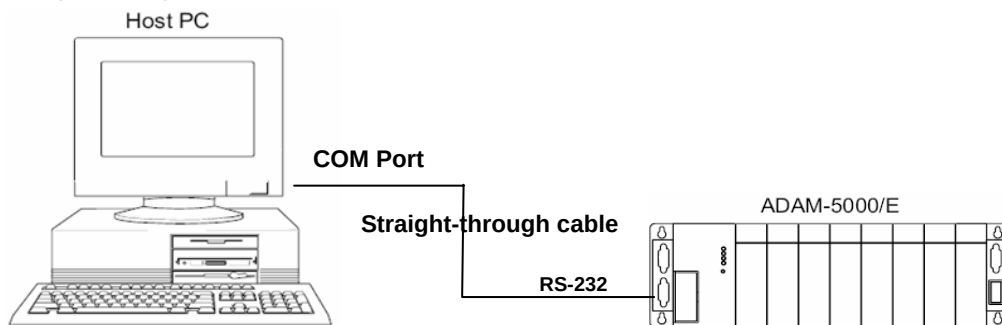


Fig. 2.1 Connect PC and ADAM-5000/E by straight-through cable

Before searching the ADAM module with ADAM-4000-5000 utility, please initialize the settings, set switches No.1-NO.7 in Node ID to OFF, and NO.8 to ON as follows:



Fig. 2.2 ADAM modules Node ID

Then, you can find the firmware version, and set communication protocol, Modbus Address of each channel etc., as follows:

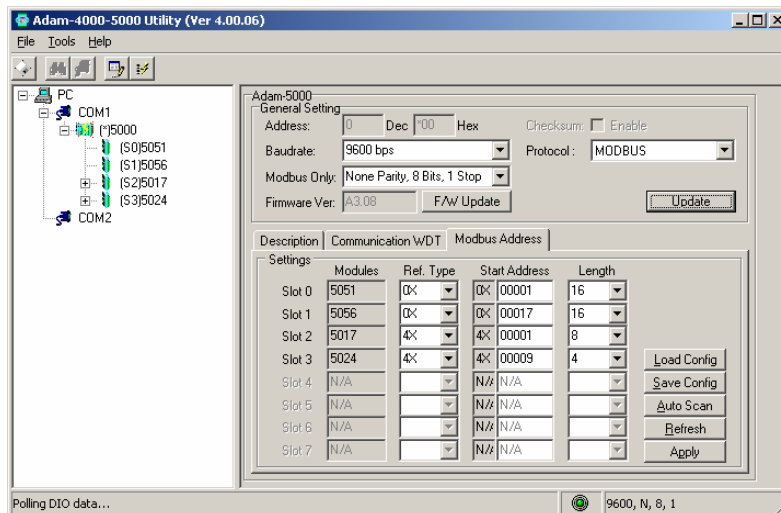


Fig. 2.3 ADAM-5000/E modules Modbus Setting

Then, you can set the ADAM module Address from 1 to 255 by setting Node ID switches NO.1-NO.7 and keep NO.8 to OFF, search ADAM modules again, you will see as follows, and you can test the modules in each slot.

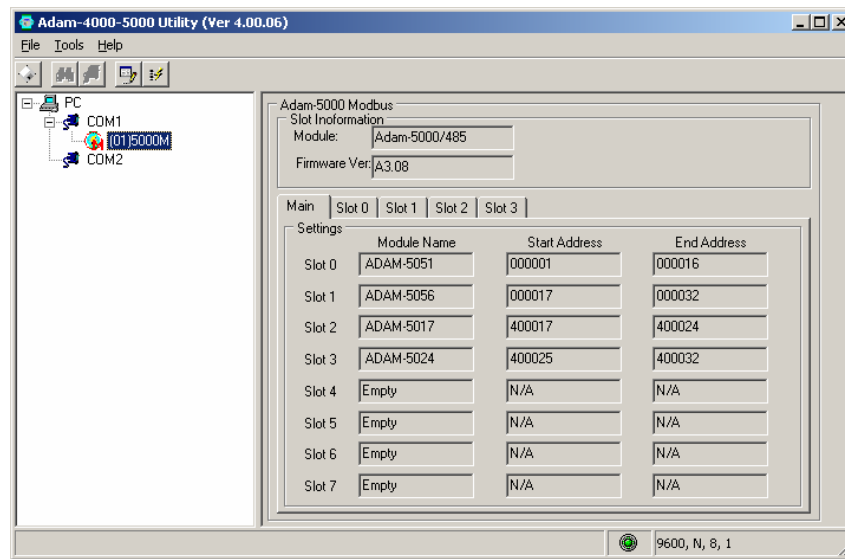


Fig. 2.4 ADAM-5000/E modules run Modbus protocol

After verifying that all the channels are OK, move to the next step to configure Advantech WebAccess.

2.2 ADAM-5000/TCP Series

When apply ADAM-5000/TCP Series modules in Advantech WebAccess, you can use a cross-over Ethernet cable to initialize device with ADAM-5000TCP/6000 utility.

Note:

1. Close host PC windows Firewall before using ADAM-5000TCP/6000 utility, or set ADAM-5000TCP/6000 utility as the exception in the Firewall.
 2. Set your host PC to static IP address.
-

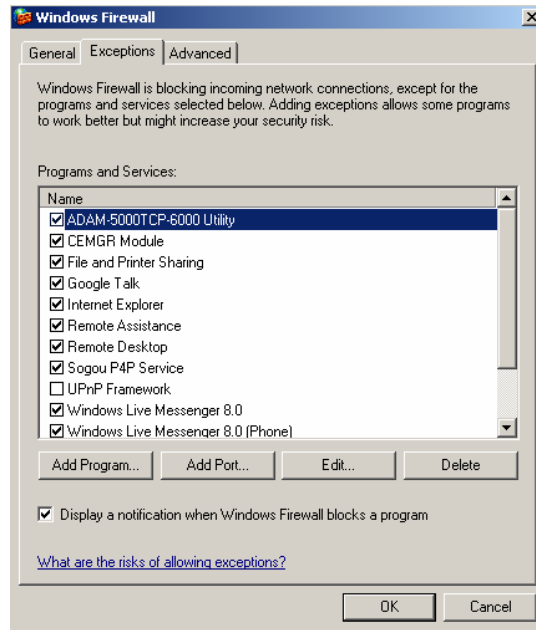


Fig. 2.5 Set ADAM-5000TCP utility in Windows Firewall

After setting host PC Firewall correctly, connect ADAM modules with PC with cross-over cable, then start up ADAM-5000TCP/6000 utility and you will see the following:

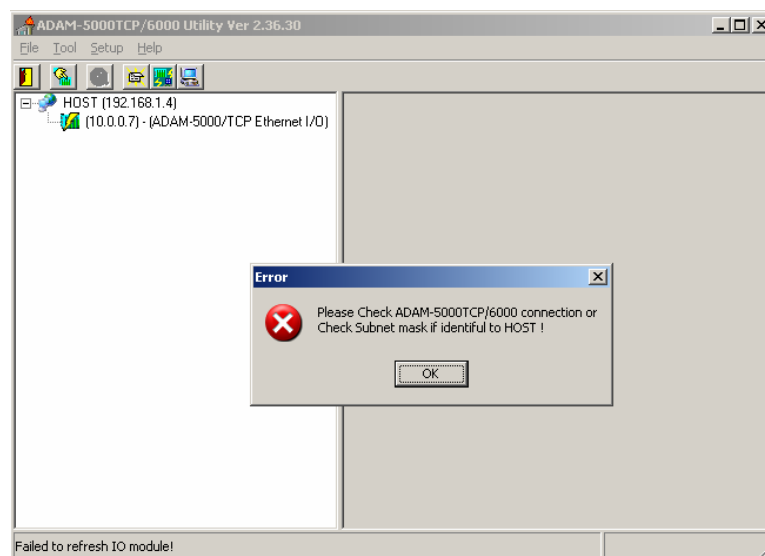


Fig. 2.6 Configure ADAM-5000/TCP with its utility

The ADAM-5000/TCP set 127.0.0.1 as its default IP address, and if the subnet mask is different with host PC, the error message will be shown, omit this message and continue the initialization, after you omit the error message, you will see the following:

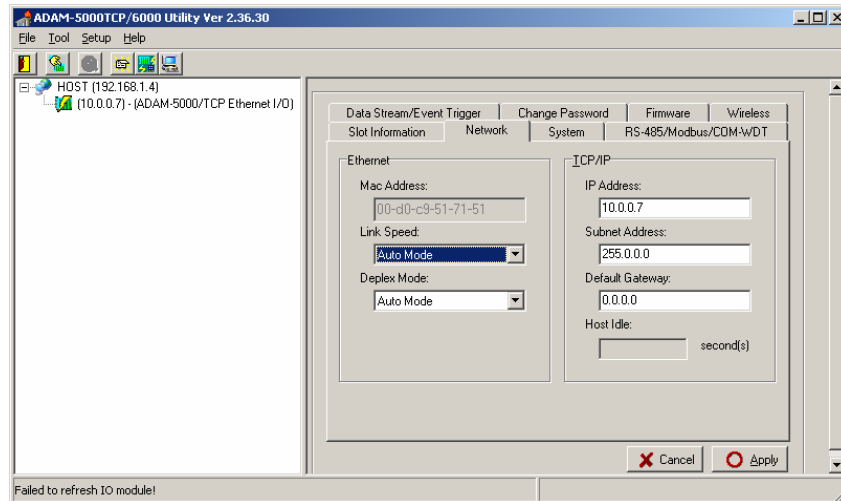


Fig. 2.7 The original status before configuration

After configuring the TCP/IP protocol as your host PC settings, it will be compatible with the Router, and can connect correctly,

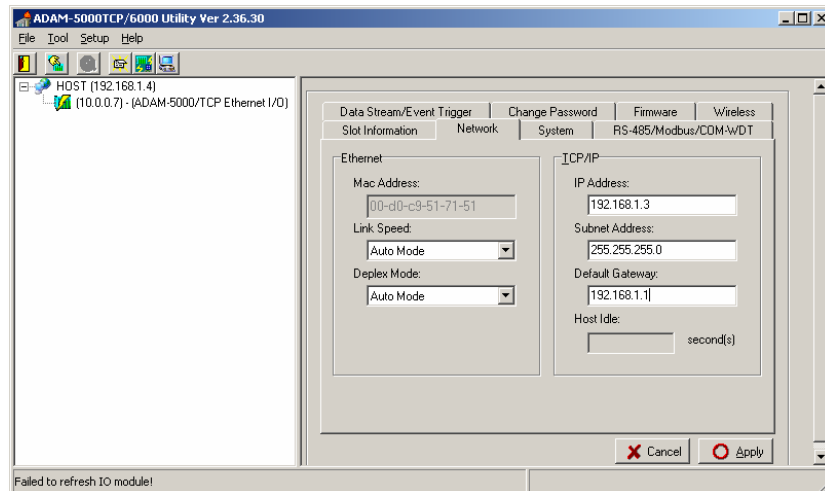


Fig. 2.8 After TCP/IP protocol configuration

Click "Apply" button, you will be prompted to enter password, the default password is: 00000000(eight zeros), click "apply", the module will be reconnected, a successful message will be popped up, as follows:

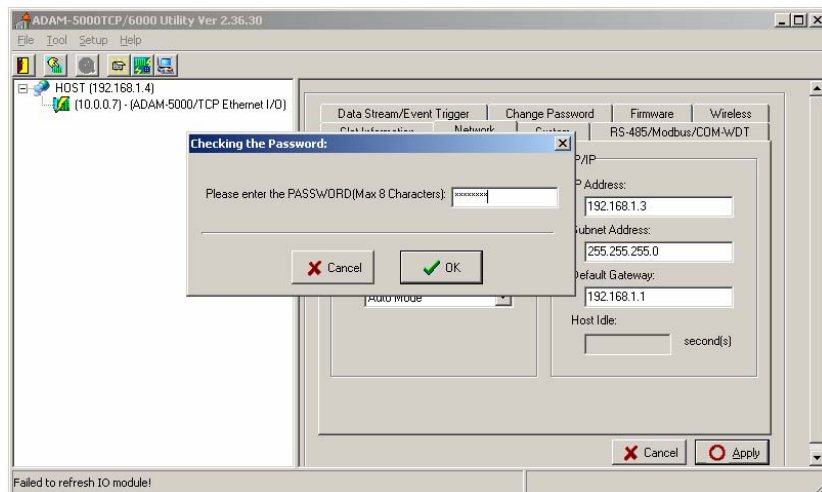


Fig. 2.9 Make sure password dialog

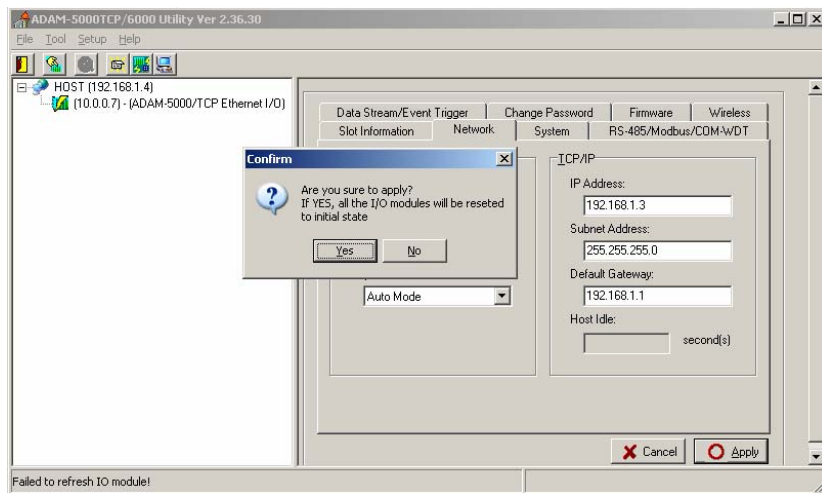


Fig. 2.10 Make sure "Apply" dialog

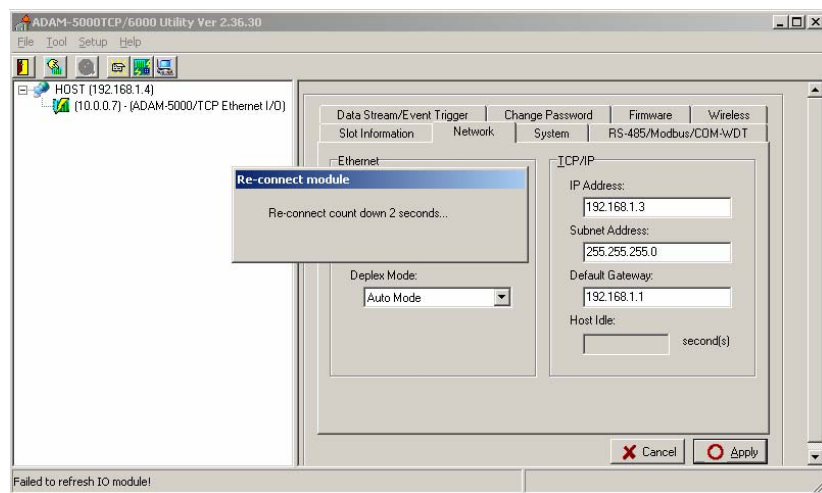


Fig. 2.11 Reconnect module dialog

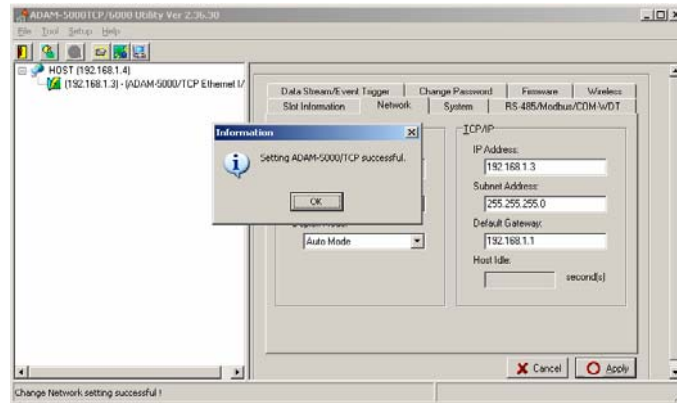


Fig. 2.12 Show “successful apply” dialog

Then you will see the correct firmware version message, and can test each slot module, After all these procedures, you will get each module's Modbus address, then you can configure Advantech WebAccess.

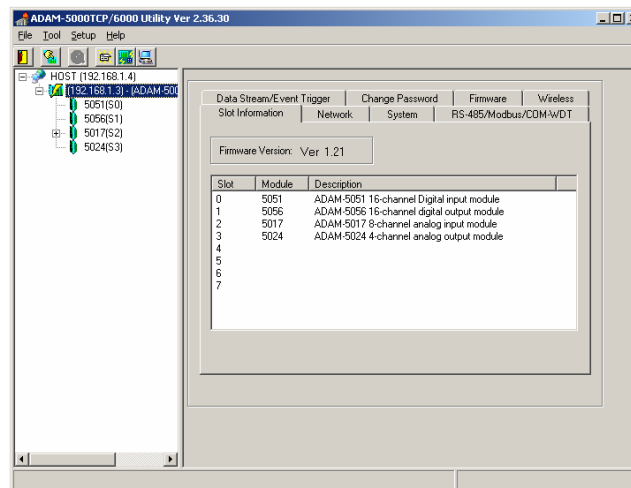


Fig. 2.13 Some information about ADAM-5000/TCP module

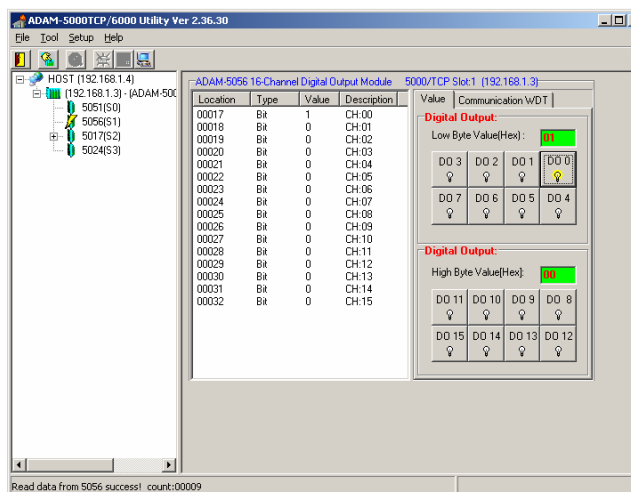


Fig. 2.13 Test ADAM modules with ADAM-5000/TCP utility

2.3 ADAM-5510 Series

When you apply ADAM-5510 Series modules in Advantech WebAccess, use a cross-over RS-232 cable to test device with ADAM-4000-5000 utility.

Before testing ADAM-5510 modules, please set NODE ID at first: SW1, SW6, SW7, and SW8 to ON, others to OFF. Be sure to use ADAM 5510 module's COM1 Port with RS-232.

In this utility, ADAM-5510 module will be shown as 5000/E module, as follows (use ADAM-5510EKW/TP for example):

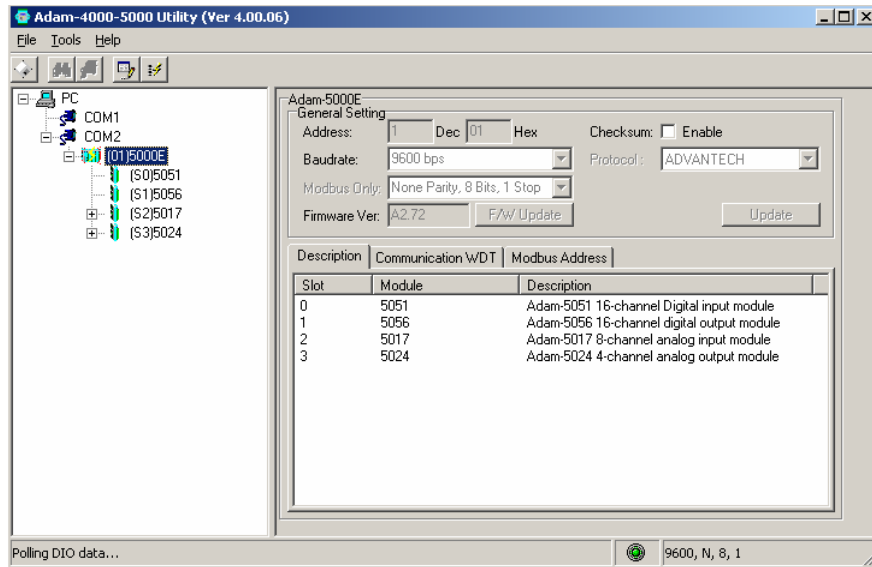


Fig. 2.14 Test ADAM-5510EKW/TP with ADAM-4000-5000 utility

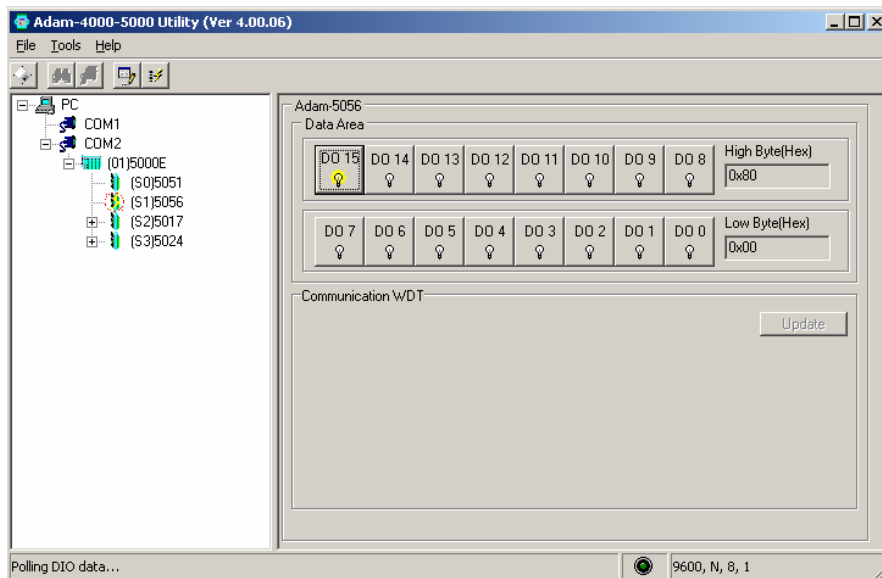


Fig. 2.15 Some test of ADAM-5000 modules in ADAM5510EKW/TP

Configure ADAM-5510EKW/TP with MULTIPROG software. ADAM-5510EKW/TP supports both Modbus Ethernet and Modbus RTU, here we will describe them respectively.

2.3.1 Run Modbus RTU

ADAM-5510 Series modules run Modbus RTU by serial port should be configured as follows (please refer to relative manuals for information on how to build ADAM-5510 project in KW MULTIPROG). Here, you should set NODE ID as: SW1 to ON, others to OFF. Use a cross-over RS-232 cable to connect ADAM-5510 module COM1 port with host PC.

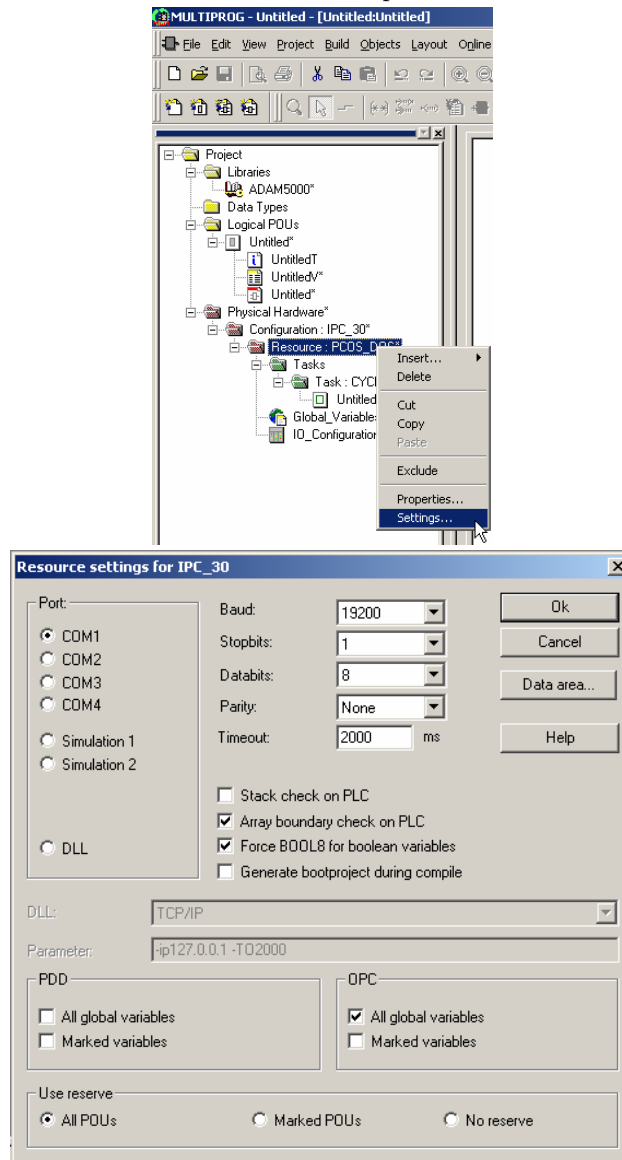


Fig. 2.16 Configure COM Port of ADAM5510 module

For example, you can build a ladder diagram as follows,

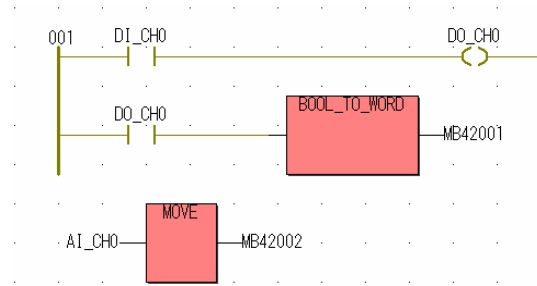


Fig. 2.17 An example of ladder diagram

After compiling the project, download it to ADAM5510 module, and make sure leading project is downloaded together.

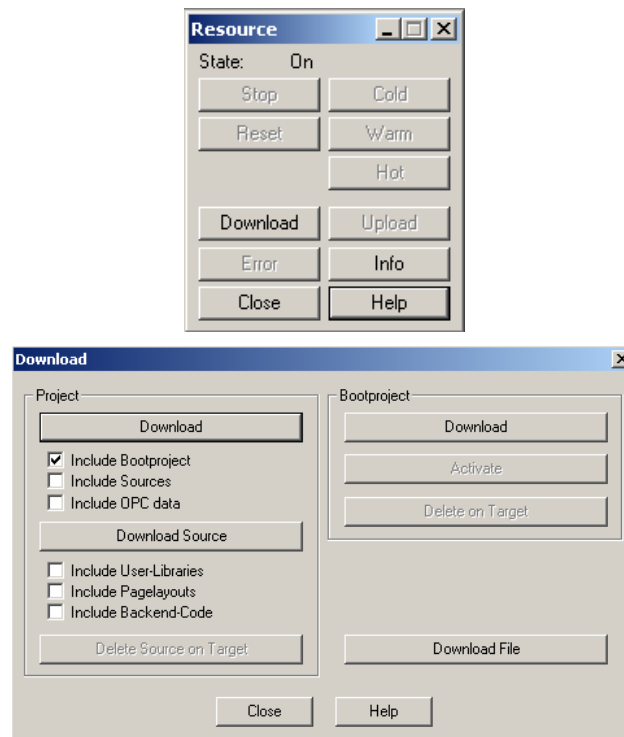


Fig. 2.18 Start and download dialog

In the debug mode, you will see as follows,

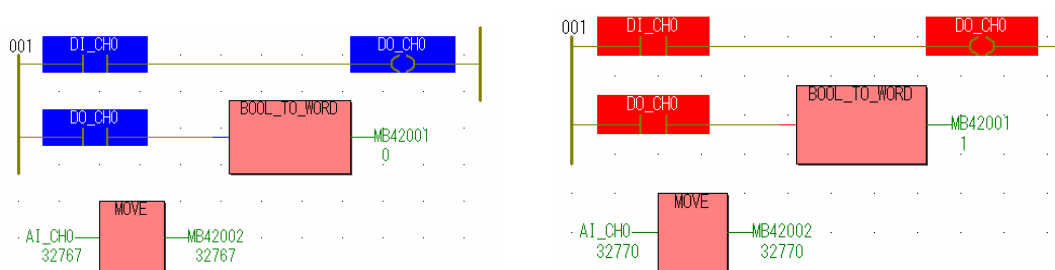


Fig. 2.19 The ladder diagram in debug mode

Then, you can configure Advantech WebAccess with Modbus RTU protocol.

2.3.2 Run Modbus Ethernet

ADAM-5510 modules, such as ADAM-5510EKW/TP module have Ethernet Port support Modbus Ethernet, you can configure these devices as follows.

Firstly, configure TCP/IP protocol by ADAM-5510 Series Utility. Use a straight-through RS-232 cable to connect host PC and ADAM-5510 module COM3 port. Set NODE ID as: SW1 to ON, others to OFF.

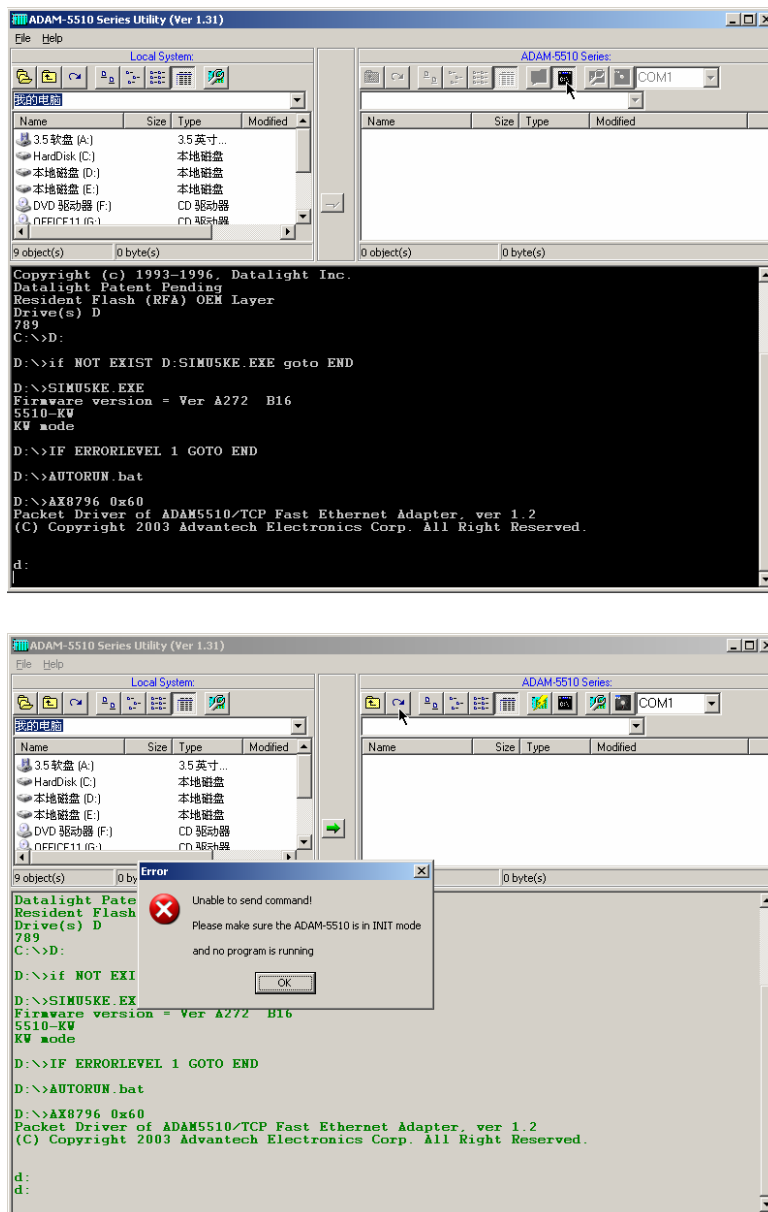


Fig. 2.20 Connect ADAM-5510 module with ADAM-5510 Utility

You will see this error message if you didn't set ADAM5510 in Initialization mode, so please connect INIT* pin to power GND pin and then reboot, as follows,

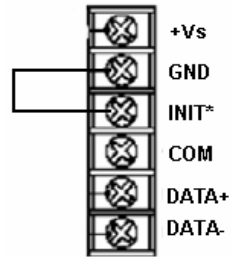


Fig. 2.21 Set initialization status of ADAM-5510EKW/TP

Then, you can see the file in ADAM-5510EKW/TP module RAM after you click “refresh” button, Click “configuration” button to set TCP/IP protocol, as follows,

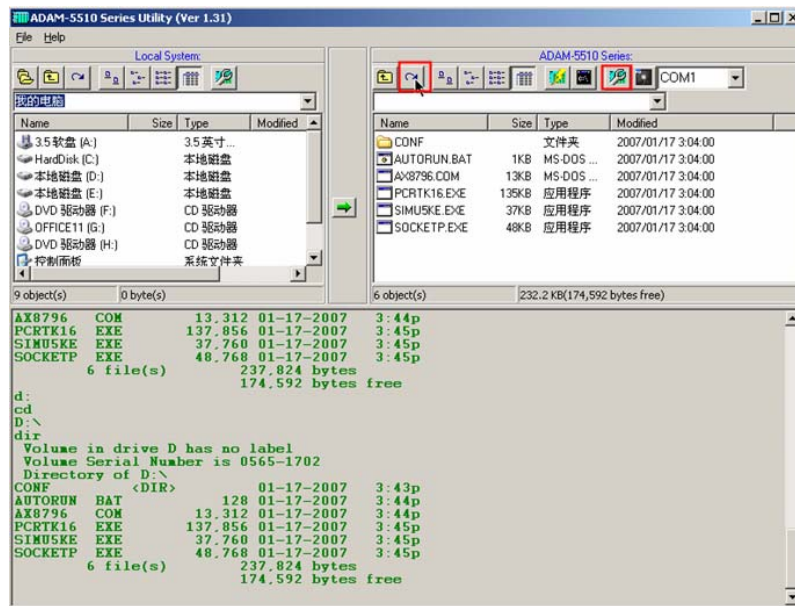


Fig. 2.22 Get file in ADAM-5510 module RAM

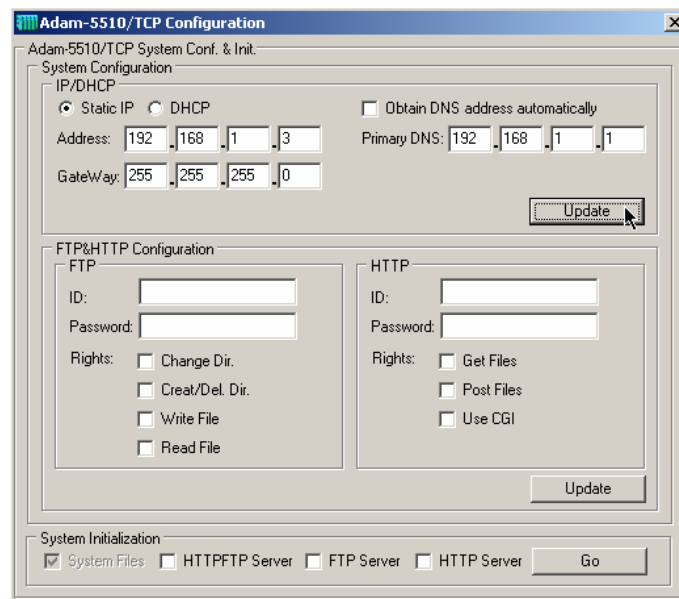


Fig. 2.23 Configure ADAM-5510 module TCP/IP protocol

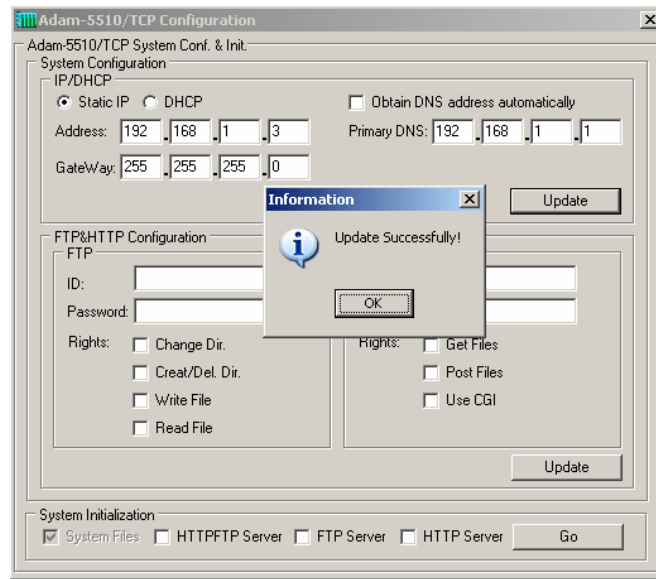


Fig. 2.24 Configure TCP/IP protocol successfully

Remove the connection between INIT* pin and GND pin, reboot again, you will see the IP address is set correctly,

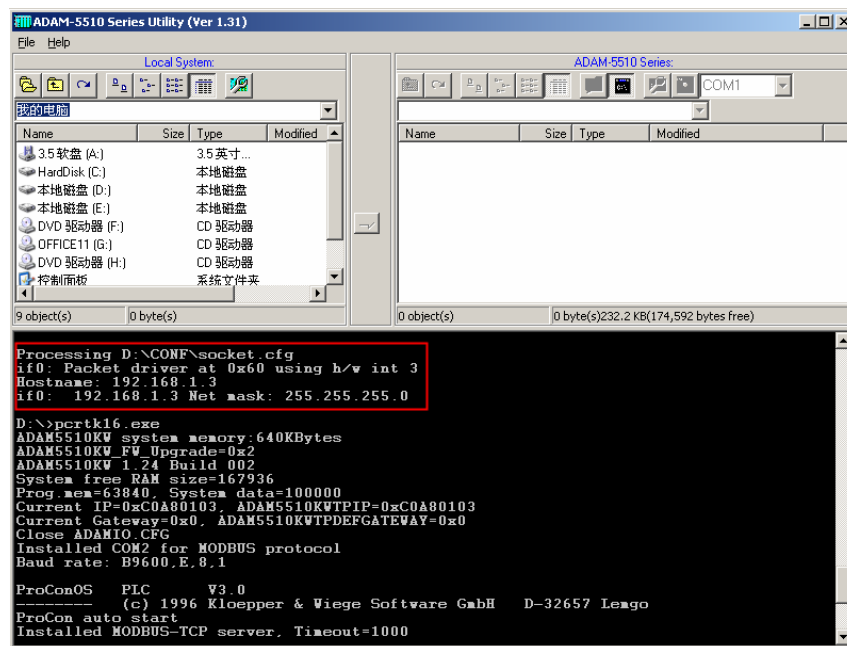


Fig. 2.25 IP Address correctly setting message

Set ADAM-5510 project in MULTIPROG based on above settings, and make some changes as follows,

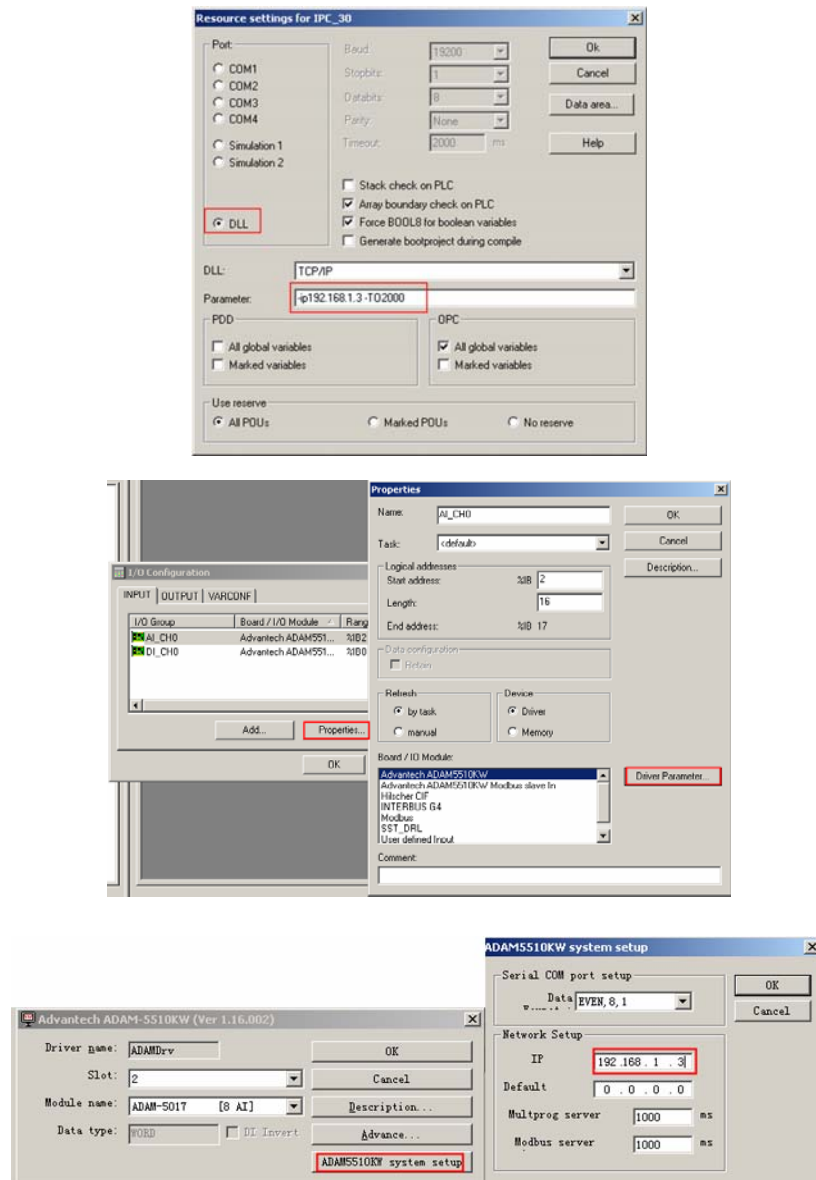


Fig. 2.26 Configure Modbus Ethernet function in KW MULTIPROG

Reset project running in ADAM-5510 module, and download them as follows, reboot again, test them in KW MULTIPROG, and configure Advantech WebAccess.

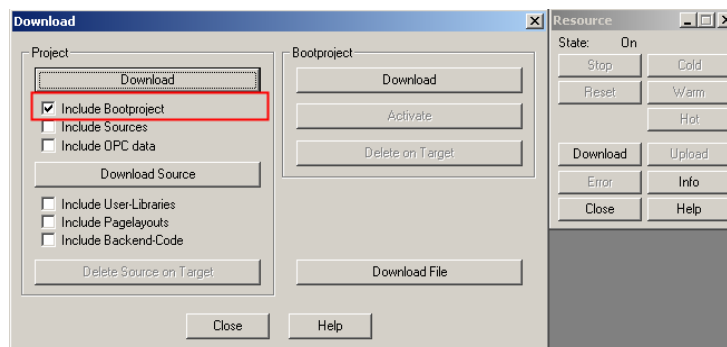


Fig. 2.27 Re-download project running in ADAM-5510 module RAM

2.4 ADAM-6000 Series

You can configure ADAM-6000 Series the same with ADAM-5000/TCP, with the same ADAM-5000TCP/6000 Utility, but when you connect ADAM-6500/6501 modules which run WinCE OS, you should use uScope Utility to configure them. For details, please refer to ADAM-6000 Series manual.

3. Software Configuration

The main problem of setting ADAM modules with Advantech WebAccess is the communication settings; we will show details in the following chapters. For ADAM AI/AO module, it is necessary to change Modbus data to real data. The calculation formula is as follows:

1. ADAM AI module

Modbus data precision in ADAM AI module is 65536(2^{16}), so if you select the AI input range as $\pm 10V$, the conversion of data is as follows:

Real = Modbus Data / 65535 * (Max. value - Min. value) + Min.

Note: all these values are signed value

2. ADAM AO module

Modbus data precision in ADAM AO module is 4096(2^{12}), so if you select the AO output range as 0~10V, the conversion of data is as follows,

Real = Modbus Data / 4095 * (Max. value - Min. value) + Min.

Note: all these values are signed value

3.1 ADAM-5000/485 Series

There is nothing special about ADAM-5000/485 Series module communication settings, you can just set it as normal, make sure the serial port is corresponding to real COM port in host PC, and the ADAM device ID is correctly set, the NODE ID should be set as (if the device ID is set as 1): Only SW1 to ON, others to OFF.

Comport : ADAM5K • MODBUSRTU • 1	
Interface Name	SERIAL
Comport Number	1
Description	Description
Baud Rate	9600 bps
Data bit	8 bits
Stop bit	1 bits
Parity	None
Scan time	1 Second
TimeOut	200 MilliSecond
Retry count	3
Auto Recover Time	60 Second
HandShakeRts	Yes
HandShakeDtr	Yes
Backup Port Number	0

Fig. 3.1 Communication setting about ADAM-5000/485 Series

3.2 ADAM-5000/TCP Series

There is nothing special about ADAM-5000/485 Series module communication settings, you can just set it as normal, and you can set any communication port as TCP/IP interface which isn't relative with TCP/IP real port, just as we can set any communication port to run TCP/IP. Be sure the device property is correctly set and the default Modbus Ethernet communication port is set to "502". About NODE ID settings, please refer to ADAM-5000/485 series.

Comport Property Delete Add Device	
Comport : ADAM5KTCP • MODBUSTCP • 3	
Interface Name	TCPIP
Comport Number	3
Description	Description
Scan time	1 Second
TimeOut	200 MilliSecond
Retry count	3
Auto Recover Time	60 Second
Backup Port Number	0

Fig. 3.2 Communication setting about ADAM-5000/TCP Series

Device Property		[Cancel]	Submit
Device Name	ADAM5K		
Description	ADAM5000 Series		
Unit Number	1		
Device Type	ADAMModbus		
Primary	IP Address	172.21.67.50	
	Port Number	502	
	Device Address	1 if other than Unit Number	
Secondary	IP Address		
	Port Number		
	Device Address		

Fig. 3.3 Device property about ADAM-5000/TCP Series

3.3 ADAM-5510 Series

ADAM-5510 series Modbus RTU and Modbus Ethernet settings are different from ADAM-5000 series, especially for ADAM-5510KW/EKW/TP. When configure ADAM-5510 series with Advantech WebAccess, you should specially set Node ID as follows:

SW1-SW5 set as Device ID, setting SW1 to ON to represent Device No.1, setting SW6 to ON, SW7-SW8 to OFF to represent using ADAM-5510 module COM1 port with a baud rate of 9600 bps. Please refer to user manual for details.

The serial setting is as follows,

Comport : ADAM5510 • MODBUSRTU • 1		
Interface Name	SERIAL	
Comport Number	1	
Description	Description	
Baud Rate	9600 bps	
Data bit	8 bits	
Stop bit	1 bits	
Parity	Even	
Scan time	1 Second	
TimeOut	2000 MilliSecond	
Retry count	6	
Auto Recover Time	60 Second	
HandShakeRts	Yes	
HandShakeDtr	Yes	
Backup Port Number	0	

Fig. 3.4 Communication setting about ADAM-5510EKW/TP Series

About the device and TCP/IP setting, please refer to ADAM-5000 series.

3.4 ADAM-6000 Series

You can set ADAM-6000 Series as the ADAM-5000/TCP, please refer to that chapter.

4. Example

Here we take ADAM-5000/TCP as example to show the whole configuration process.

Step 1, set a new project in project Node as follows,

Fig. 4.1 Setup a new ADAM5000/TCP project

Step 2, you should enter project, and set up a SCADA Node as follows,

Current Project(s)							
Project Name	Description	IP	HTTP Port	TCP Port	TimeOut	Update	Delete
ADAM5KTCP	ADAM5K/TCP Project	172.21.67.51	0	0	0	Update	Delete

Please select one of above available Projects to start!!

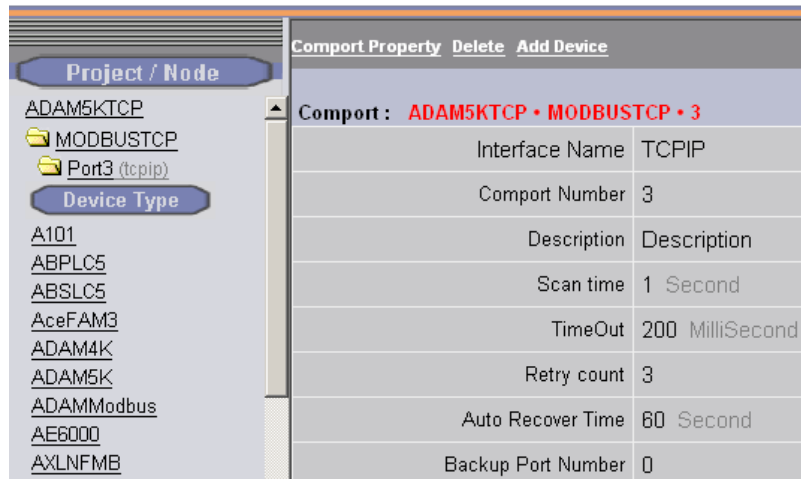
[Integrity Checking](#) [Backup](#) [Restore](#) [Admin/Project User](#) [ODBC Log Data Source](#)

[System Log](#) [Action Log](#) [Alarm Log](#) [Analog Tag Log](#) [Analog Change Log](#) [Discrete Tag Log](#) [Text Tag Log](#) [Event Log](#) [LogData Maintenance](#)

Node Property	
Node Name	MODBUSTCP
Node Description	
SCADA Node IP Address	172.21.67.51
Primary TCP Port	0
Node Time Out	0
Remote Access Code	
Outgoing Email (SMTP) Server	172.21.67.51

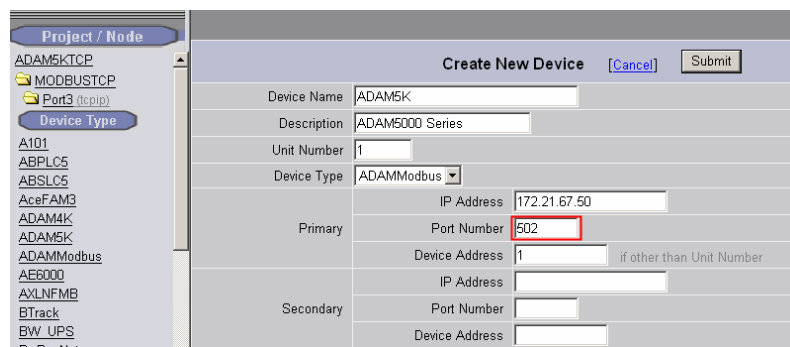
Fig. 4.2 Setup a new ADAM5000/TCP SCANDA Node

Step 3, configure the basic element such as: a communication port with TCP/IP protocol, a device to map ADAM-5000/TCP and the TCP/IP setting such as: IP address, Modbus Ethernet communication port “502” etc., then set up the tags to map ADAM5000 modules, as follows,



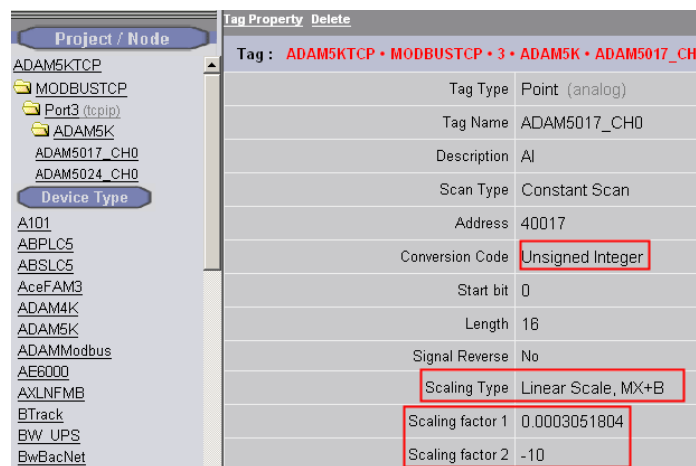
Comport Property	
Interface Name	TCPIP
Comport Number	3
Description	Description
Scan time	1 Second
TimeOut	200 MilliSecond
Retry count	3
Auto Recover Time	60 Second
Backup Port Number	0

Fig. 4.3 Setup a new communication port



Create New Device	
Device Name	ADAM5K
Description	ADAM5000 Series
Unit Number	1
Device Type	ADAMModbus
Primary IP Address	172.21.67.50
Primary Port Number	502
Primary Device Address	1 if other than Unit Number
Secondary IP Address	
Secondary Port Number	
Secondary Device Address	

Fig. 4.4 Setup a new device



Tag Property	
Tag : ADAM5KTCP • MODBUSTCP • 3 • ADAM5K • ADAM5017_CH0	
Tag Type	Point (analog)
Tag Name	ADAM5017_CH0
Description	AI
Scan Type	Constant Scan
Address	40017
Conversion Code	Unsigned Integer
Start bit	0
Length	16
Signal Reverse	No
Scaling Type	Linear Scale, MX+B
Scaling factor 1	0.0003051804
Scaling factor 2	-10

Fig. 4.5 Setup a new tag about ADAM-5017 channel 0

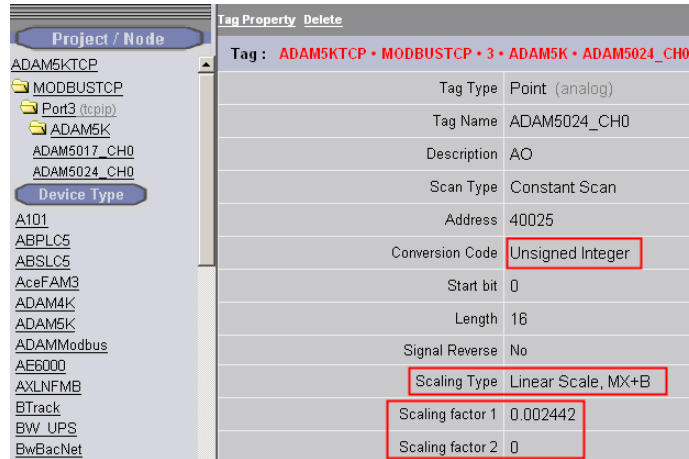


Fig. 4.6 Setup a new tag about ADAM-5024 channel 0

Step 4, after you download the whole configuration and start SCADA Node, you will see the follows,

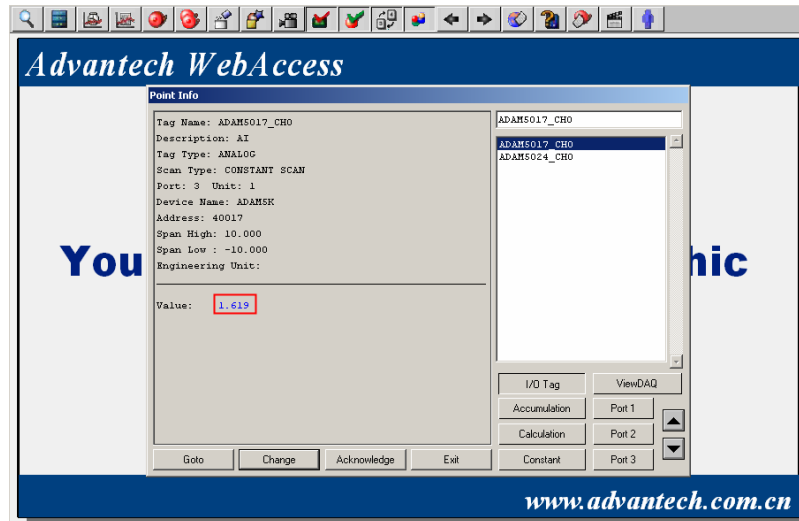


Fig. 4.7 Monitor the tag of ADAM-5017 channel 0 information

You can also change the data by ADAM-5000/TCP utility and validate whether the display data is real value, as follows,

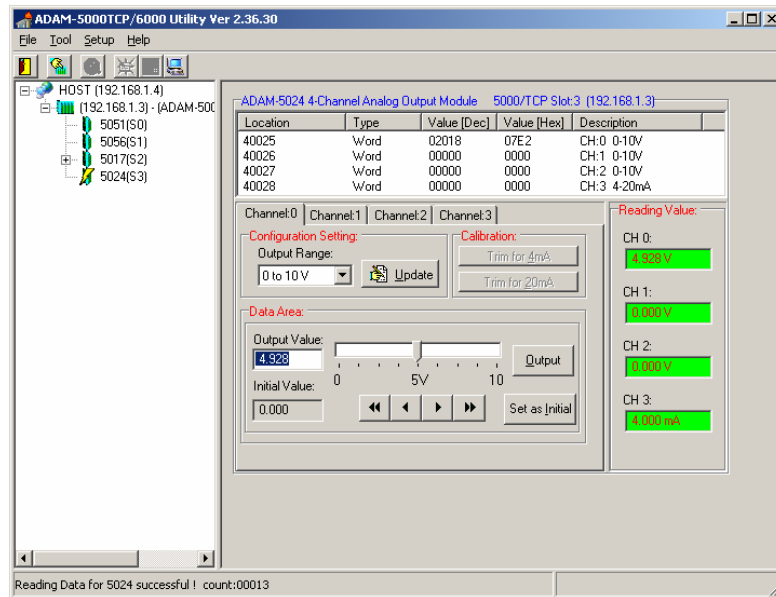


Fig. 4.8 Change Tag value of some ADAM module by its utility

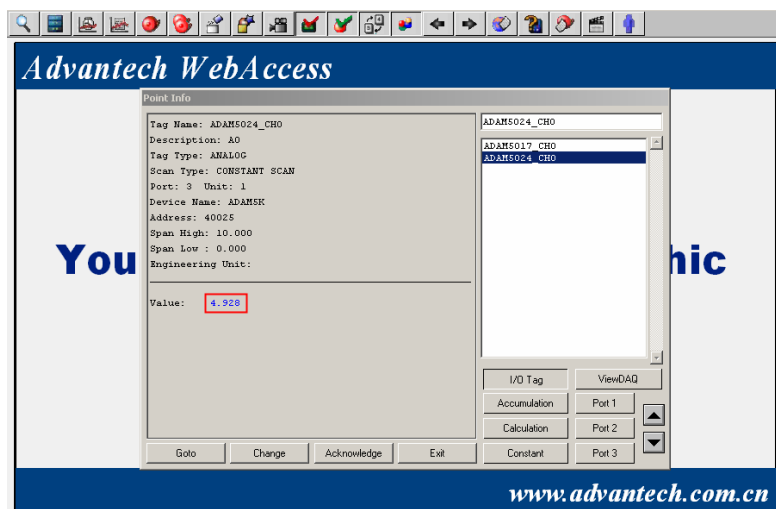


Fig. 4.9 Validate the tag of ADAM-5024 channel 0

Following the above example, you can set up an Advantech WebAccess project running ADAM modules easily and conveniently!